

#### CIA-RDP86-00513R000617320008-4 "APPROVED FOR RELEASE: 09/19/2001 SAR PROFESSOR AND THE SECOND PROFESSOR AND A SECOND PROFESSOR AND A

HULYHYEV, A.R

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Call No . TWole. Vo. BOOK

Author: GULYAYEV, A. P. Full Title: TRANSFORMATION OF AUSTENTIE TO FERTING TE

Transliterated Title: Prevrashcheniye austenita a garrensit

Publishing Data Originating Agency: All-Union Scientific Engineering and Technical

Society of Machine Builders. Crals Branch State Selentifie and Termo val fublishing House

Publishing House: of Machine Building Literature ("Fashgiz")

No. of coples. No. pp.: 25 Date: 1950

Text Data This is an article from the book: VSESOYUZNOYE NAUCH NOVE INZHENERNO-TEKHNICHESKOYE OBSHCHESTVO MASHINOSTROITELEY, URAL SKOYE OTDELENIYE, THERMAL TREATMENT OF METALS - Symposium of Conference (Termicheskava obrabotka metallov, materialy konferentsit), (p.48-72), see AIL 223-II Coverage:

The author presents a general review grouped about five major characteristics of Russian investigations of the mechanism of the transformation of aust-mite to martensite.

The author's study of best structured transferentions follows the same idealized conception of the phenomer a us usually adopted in many branches of physical science. The

1/2

Prevrashcheniye austenita v martematt

240 G9 - 1

study of equilibrium system and equilibrium transformation is considered important in spite of its non-equipment in practice. The idealized mechanism of the martensite transformation also has important significance for correct representation of true phenomera. The equilibrium transformation, in the authors opinion, is usually distorted as the secondary phenomeral related to the formation of relaxation, diffusional displaces at.

The scope of this review includes the fellowing questions: Theory, temperature and structure of the martentite transformation, isothermic transformation of austenite to martensite, stability of austenite, effect of cooling relocity and finally some practical recommendations, among which is discussed the question of the temperature conditions at cold treatment, temporary conditions and the effect of cold treatment. 17 charts, 6 microphotographs, 2 tables.

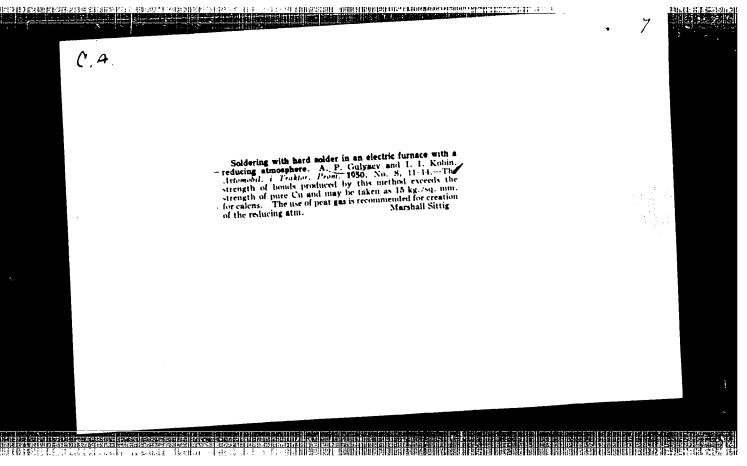
Purpose: For scientific workers

Facilities: None

No. of Russian and Slavic References. 10 (1994)

Available: Library of Congress

2/2



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# USSR/Metals - Steel, Electron Microscopy

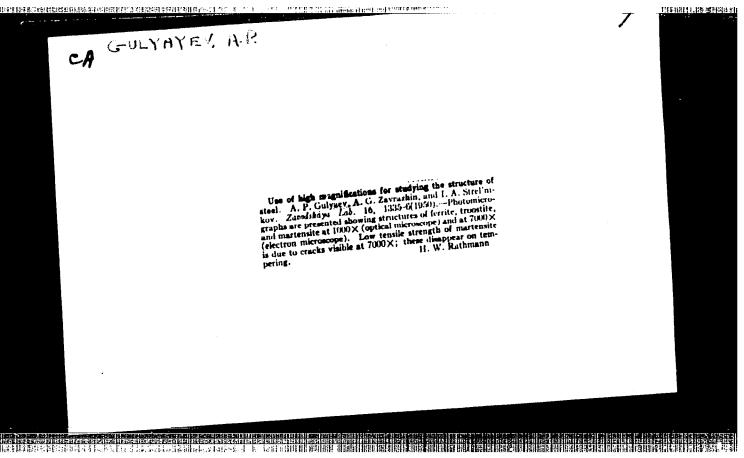
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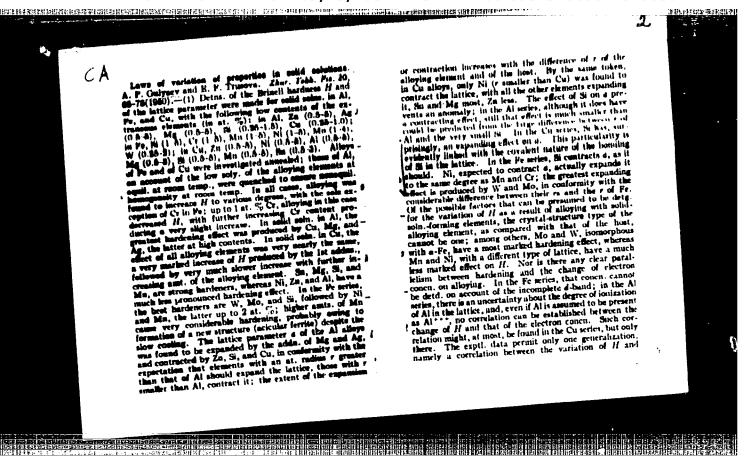
"Application of High Magnifications for Studying the Structure of Steel," A. P. Gulyayev, A. G. Zavrazhin, I. A. Strel'nikov, All-Union Sci Res Toolmaking Inst

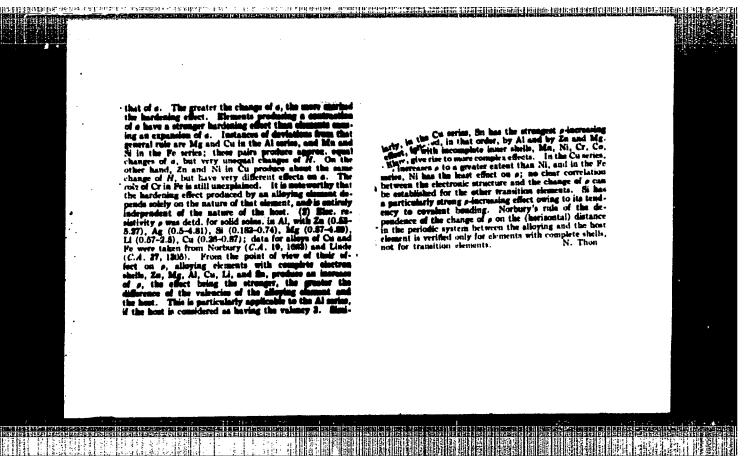
"Zavod Lab" No 11, pp 1335, 1336

Studied typical structures in steel, such as ferrite, perlite, troostite, and martensite, at high magnification of 70,000 X with aid of electron microscope. Discusses results of examn, illustrated with photomicrographs. Examd commercial iron, steel UIO and especially made steel UIO (1.54%C).

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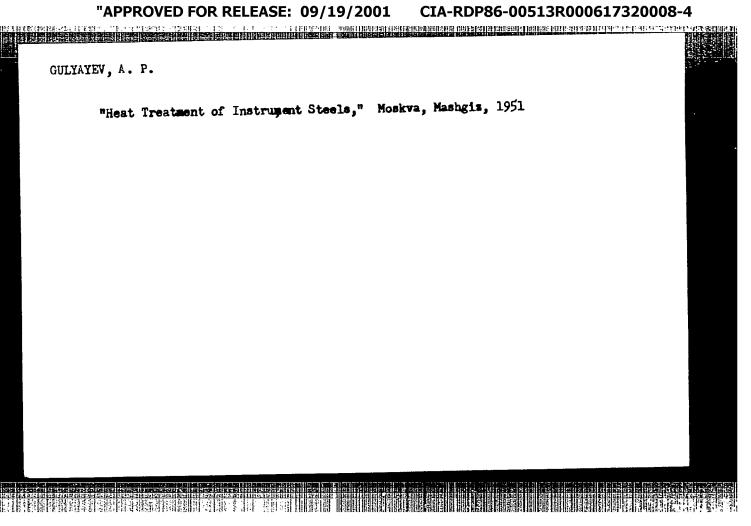
Includes bibliographies.

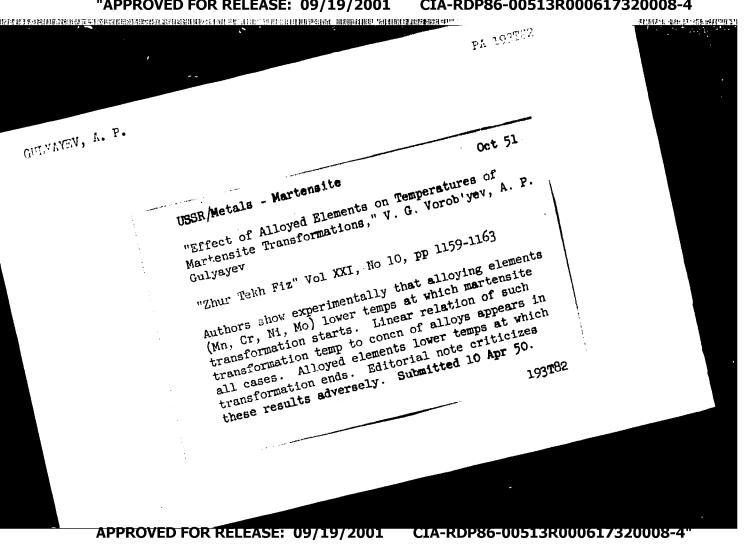
(Metallography. 2nd ed.)

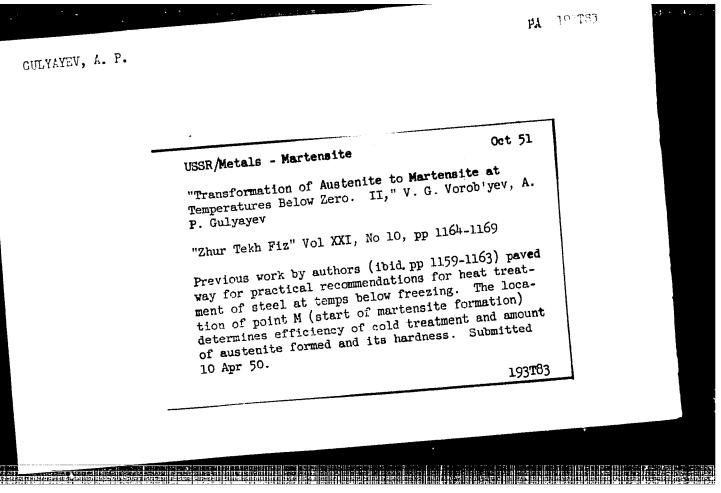
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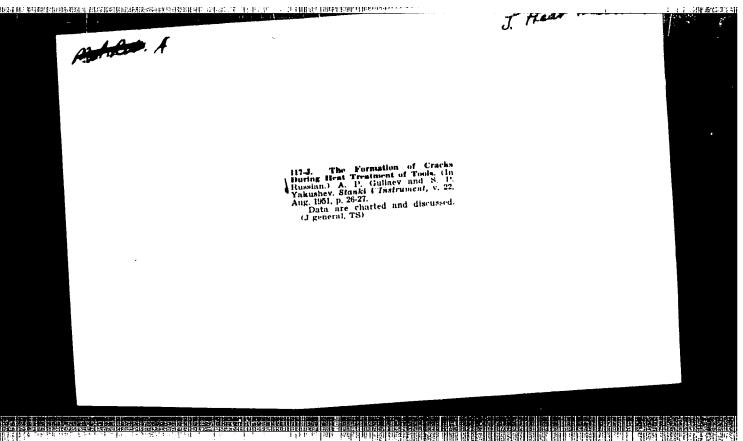
SO: Manufacturing and Mechanical Engineering in the Soviet Union, Library of Congress, 1953.

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GULYAYEV, A.P.; KUZNETSOV, I.V.; TIKHONRAVOVA, T.L.; MATVEYEVA, Ye.N., tekhnicheskiy redaktor

[Stabilization of the dimensions of ball-bearing races by means of cold treatment in tempering] Stabilizatsiia rasmerov kolets podshipnikov putem obrabotki kholodom pri zakalke. Moskva, Gos. nauchno-tekhn.izd-vo mashinostroitel'noi lit-ry, 1952. 25 p.
[Microfilm] (MIRA 9:3)
(Ball-bearings) (Steel--Metallurgy)

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PHASE I BOOK EXPLOITATION

SOV/1843

Gulyayev, A. P. and Ye. V. Petunina

Metallograficheskoye is sle dovaniye prevrashcheniya austenita v martensit (Metallographic Investigation of the Austenite-Martensite Transformation) Moscow, Mashgiz, 1952. 90 p. (Series: Tsentral'nyy nauchno-issledovatel'skiy institut tekhnologii i mashinostroyeniya. [Trudy] kn. 47) 3,000 copies printed.

Reviewer: N. A. Pasternak, Engineer; Tech. Ed.: Ye. N. Matyeyeva; Managing Ed. for Literature on Heavy Machine Building (Mashgiz): S. Ya. Golovin, Engineer.

PURPOSE: This book is intended for scientific personnel at research institutes and industrial laboratories.

COVERAGE: Methods of investigating the austenite-martensite trans-

Card 1/6

Metallographic Investigation (Cont.)

SOV/1843

formation are described. In particular, metallographic methods of study are discussed, and the design of an instrument in current use is described. The theory of the martensite transformation is set forth, particular emphasis being laid on the ideas that nuclei of martensite crystals appear as a result of plastic deformation of austenite grains and that shear planes serve as centers of crystallization. Personalities mentioned as having made contributions in this field include G. V. Kurdyumov, N. T. Gudtsov, and N. Ya. Selyakov. There are 25 references, of which 23 are Soviet, 2 German, and 1 English.

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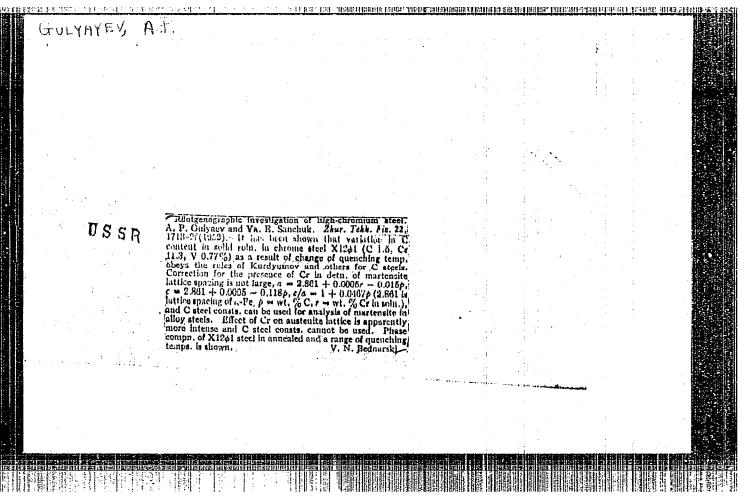
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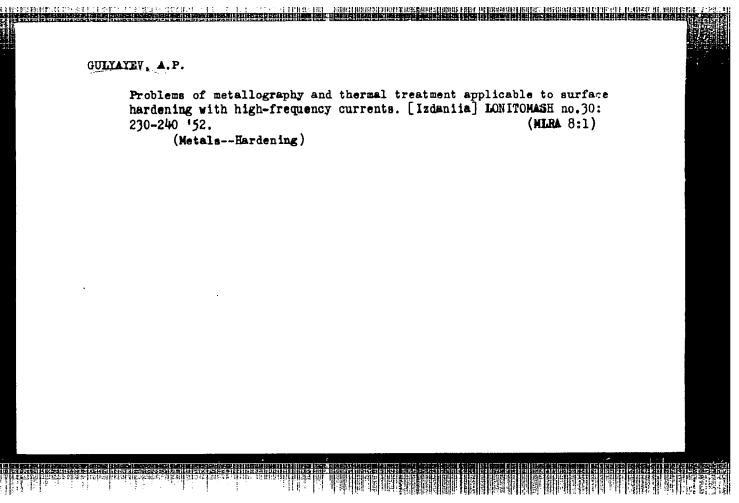
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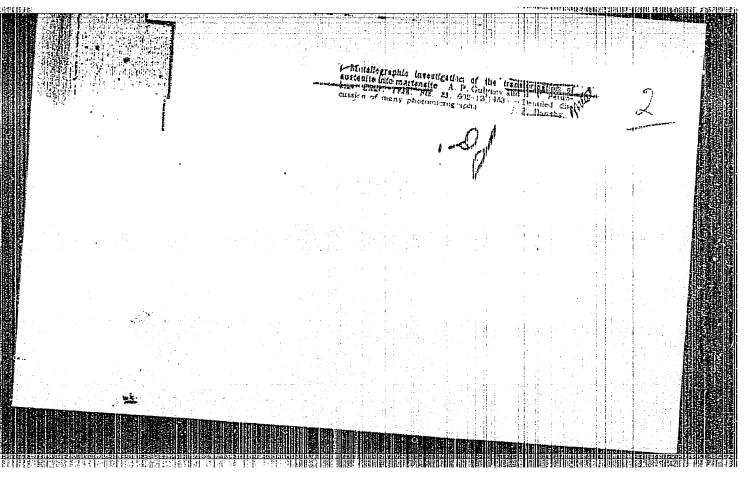
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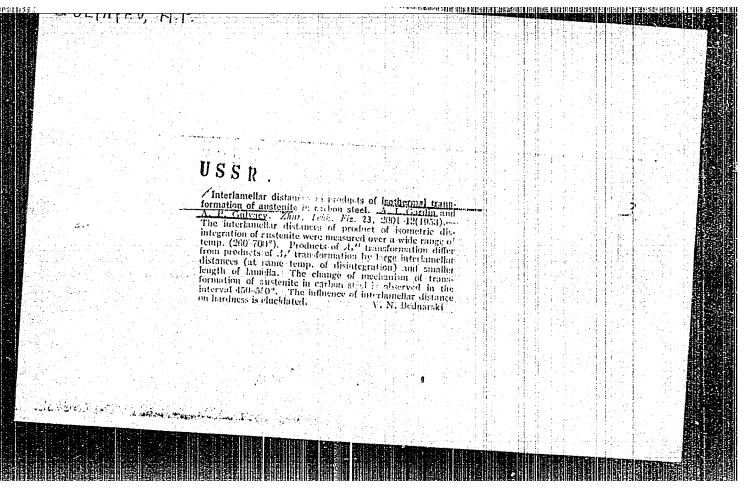
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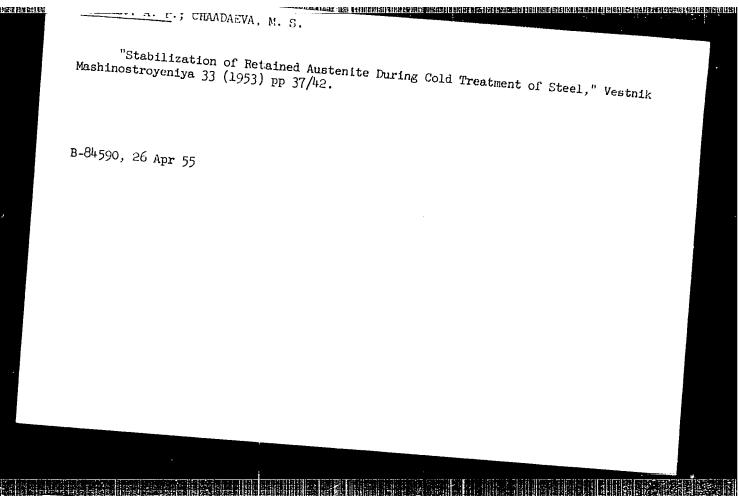
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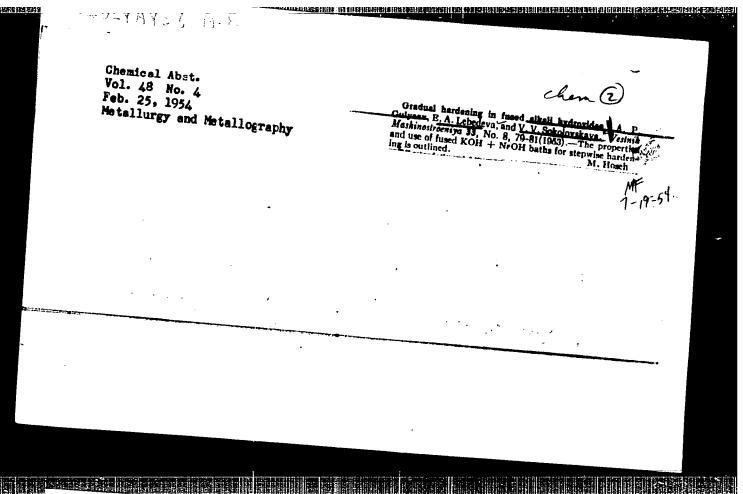
0008-4 "Stabilization of Retained Austenite," A. P. Gulyayev, of duration of holding period at given temp (-20 and -50°C); effect of temp of isothermal holding; effect duction in austenite capability of transformation to Peb 53 martensite in case of interruption in cooling. Contreatment of steel, investigates three factors which 27orgt of chem compn (C content) of austenite. Discussing enon, authors suggest only possible (in their opintheoretical substantiation of stabilization phenomion) assumption that stabilization of retained austenite is caused by stress relief during isothermal 27orgit affect stabilization of austenite, namely: effect Defines stabilization of retained austenite as residering this phenomenon unfavorable to sub-zero Steel, Retained Austenite Zhur Tekh Fiz, Vol 23, No 2, pp 252-264 USSR/Metallurgy - Refrigeration of M. S. Chaadayeva holding.

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GULYAYEV, A.P.s. doktor tekhnicheskikh nauk, professor, MATVEYEV, Te.X..

[Properties and heat treatment of tool steels] Svoiatva i termicheskaia obrabotha instrumental nykh stalei, Pod red, A.P.Guliaeva, litery, 1954, 77 p.

(Tool steel)

(MIRA 7:8)

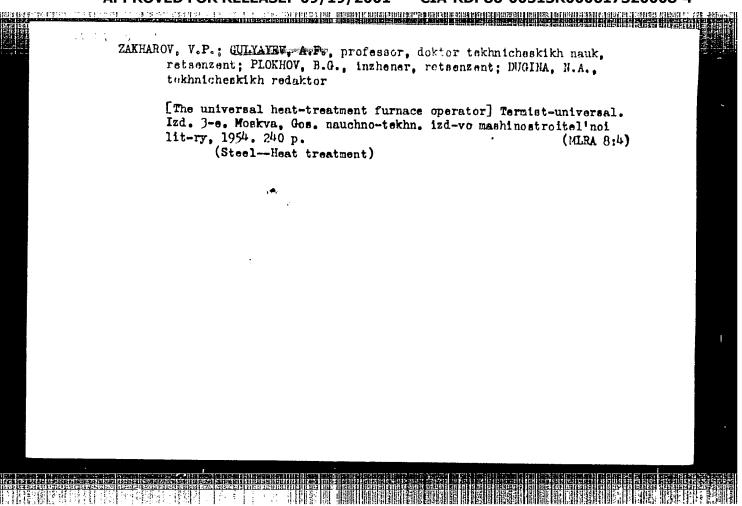
GULYAYEV, A.P., doktor tekhnicheskikh nauk, professor, redaktor; MO-DEL, B.O., tekhnicheskiy redaktor; MATVEYEV, Ye.N., tekhnicheskiy redaktor.

[Investigation of the structure of tool steels; collection of articles] Issledovanie struktury instrumental nykh stalei; sbornik statei. Pod red. A.P.Guliaeva. Moskva, Gos.nauchno-tekhn. isd-vo mashinostroit. i sudostroit. lig-ry, 1954. 136 p.

(MIRA 7:11)

1. Moscow. Vsesoyusnyy nauchno-issledovatel'skiy instrumental'nyy institut.

(Tool steel -- Metallography)



GULYÁEV, A. F.

"Transformation Processes in Steel During Hardening," from Modern Methods of Heat Treating Steel by Dom Inzhenera i Tekhnika imeni F E Dzerzhinskovo. Gosudarstvennoye Nauchno-Tekhnicheskoye Izdatel'stvo Mashinostroitel'noy Literatury, Moscow (1954) 404 pp. pp 5/23.

Evaluation B-86350, 30 Jun 55

USSR/Engineering-Metallurgy

FD-1300

Card 1/1

: Pub. 41-7/18

Author

: Gulyayev, A. P. and Zel'bet, M. P.

Title

: Metallographic study of the tempering process in hardened high-carbon

steel

Periodical

: Izv. AN SSSR. Otd. tekh. nauk 3, 83-87, March 1954

Aubstract

: Studies austenite-matensite transformation by metallographic method using steel specimens with coarse grains of austenite. Diagrams,

micrographs, three references.

Institution :

Submitted

: February 10, 1954

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USSR/Engineering-Metallurgy

FD-1381

Card 1/1

: Pub. 41-8/18

Author

: Alfimov, A. N. and Gulyayev, A. P.

Title

: On the rate of growth of martensite crystals

Periodical

: Izv. AN SSSR. Otd. tekh. nauk 3, 88-90, March 1954

Abstract

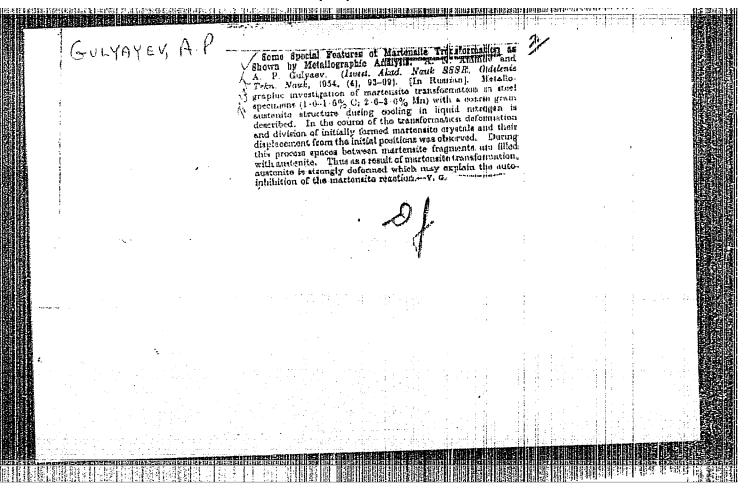
: Describes experiments conducted in ultrasonic laboratory of TsNIITMASh (Central Scientific Research Institute of Technology and Machine Building) for measuring formation time of martensite crystal, using cathoderay oscilloscope. Illustration of experimental device is given. Four

references; 1 USSR.

Institution :

Submitted :

: February 10, 1954



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FD-594

GULAYEV, A. P.

USSR/Metals - Austenite conversion

: Pub 153-6/22

Card 1/1: Gulayev, A. P., and Zalkin, V. M.

: Effect of heating speed on the position of the temperature interval Author Title

of conversion of pearlite into austenite

: Zhur. tekh. fiz. 24, 216-221, Feb 1954

: Analyze the effect of heating speed on the position of the "critical Periodical point" i.e. the point of quickest conversion of pearlite into austen-Abstract

ite. Assume that the accuracy of the experimental determination of temperature interval depends on the inertia of the recording equip-

ment and on the temperature scale and sensitivity of the oscillograph.

Results are plotted in graphs. 9 references.

Institution :

: June 28, 1953 Submitted

> **APPROVED FOR RELEASE: 09/19/2001** CIA-RDP86-00513R000617320008-4"

FD-535

GULAYEV, A. P.

USSR/Metals - Steel heating

Card 1,1

: Pub 153-7/22

Author

: Gulayev, A. P. and Zalkin, V. M.

Title

: Problem of analyzing the thermal curves of velocity heating of steel

Periodical

: Zhur. tekh. fiz., 24, 222-226, Feb 1954

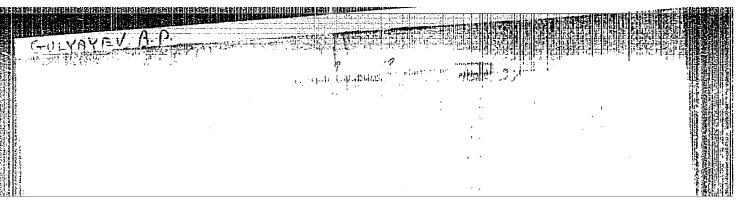
Abstract

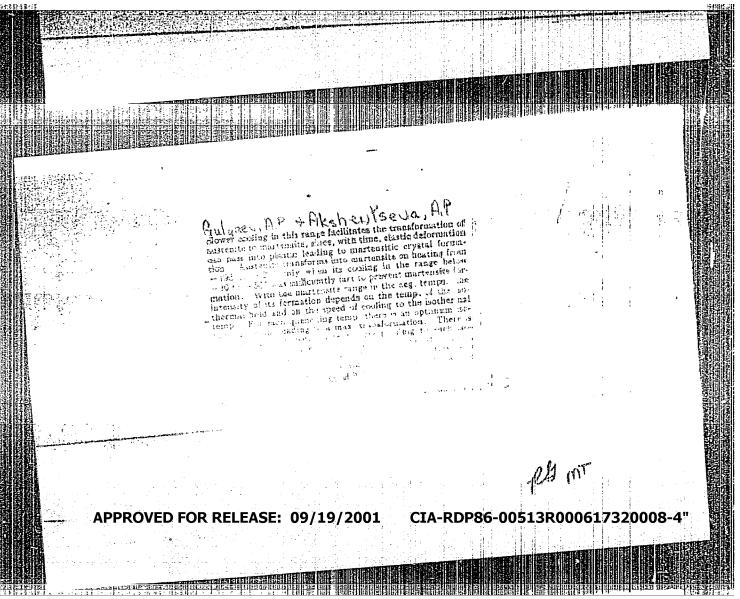
: Because the heating speed varies at conversion points (see previous abstr.) due to emission or absorption of latent heat, these points are easily found on thermal curves. But with increusing conversion speed the heat balance varies and decalescence occurs, i.e. the temperature drop as a result of conversion. These assumptions are experimentally confirmed and plotted in graphs. No references.

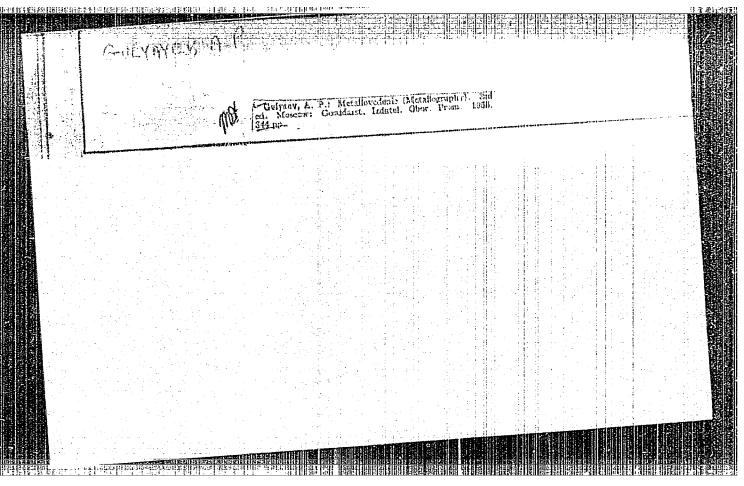
Institution :

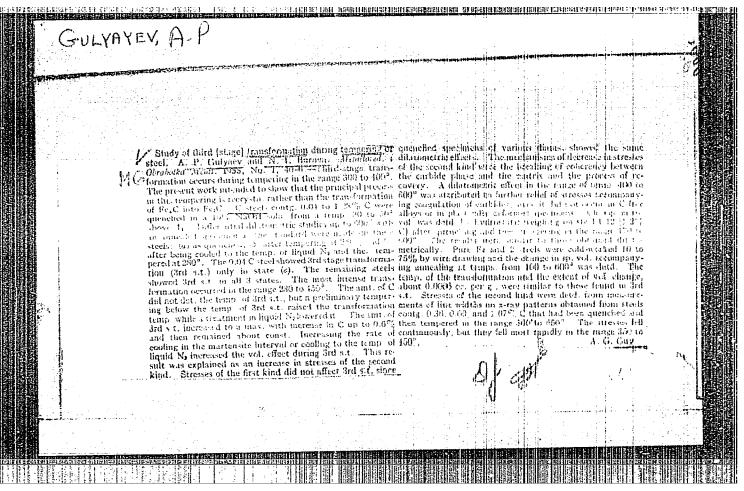
: June .8, 1953 Submitted

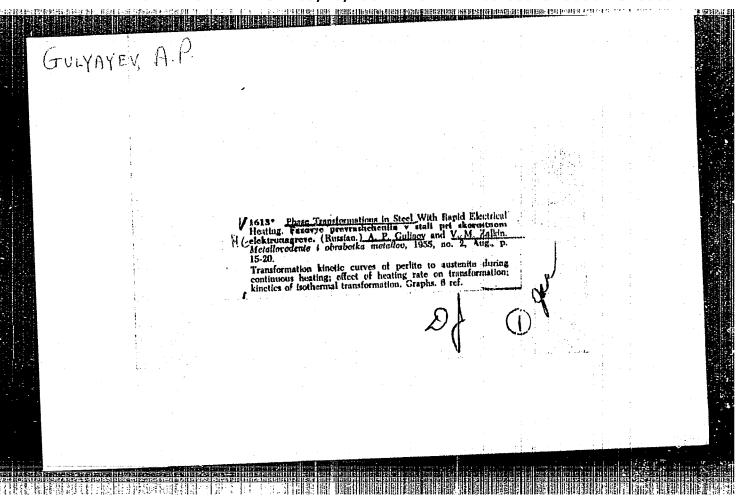
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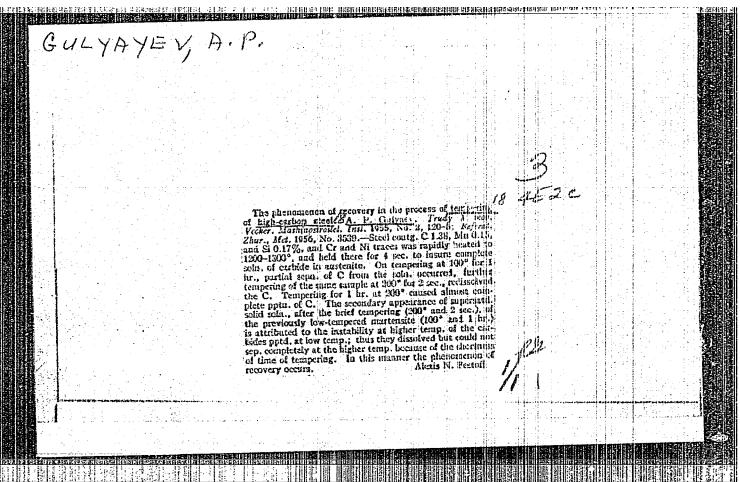


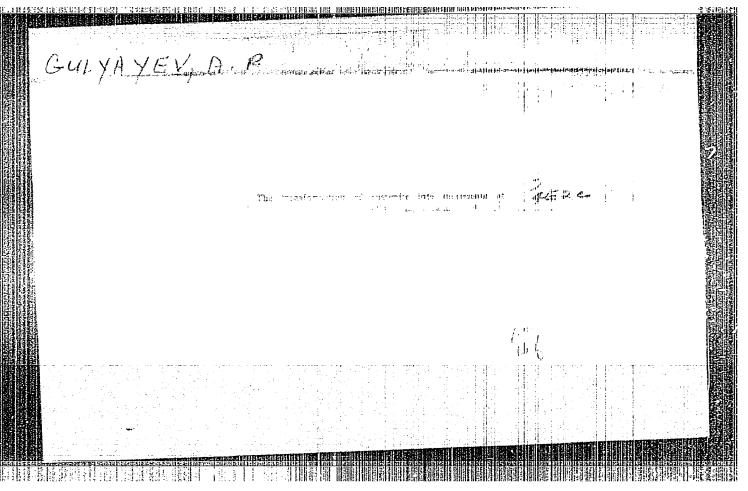


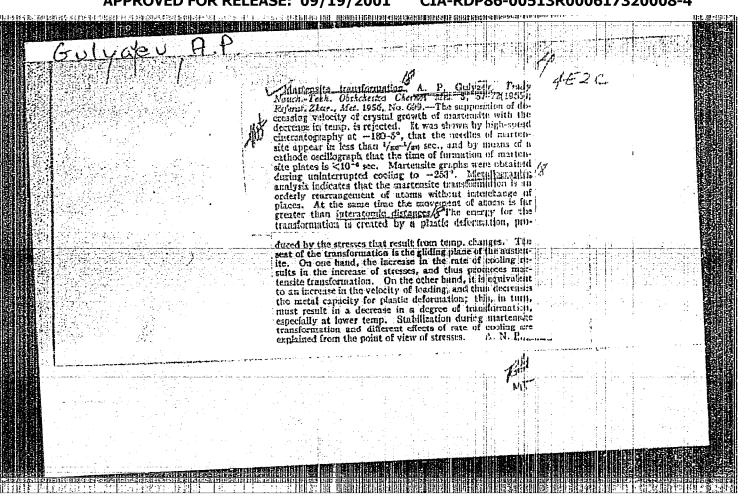


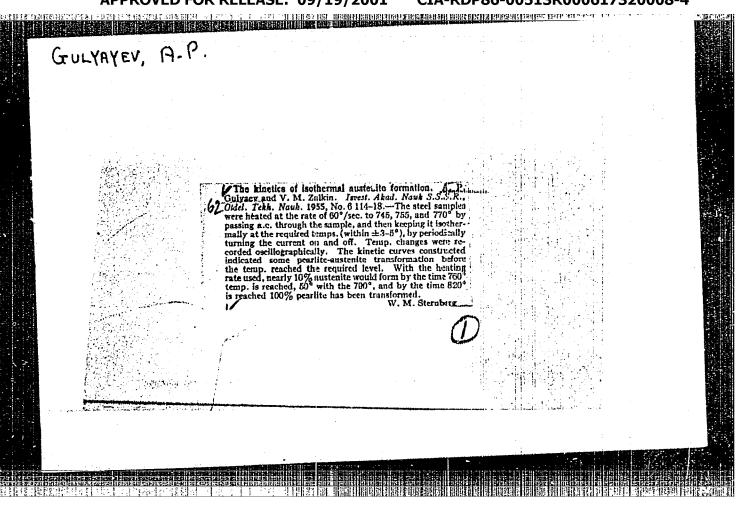


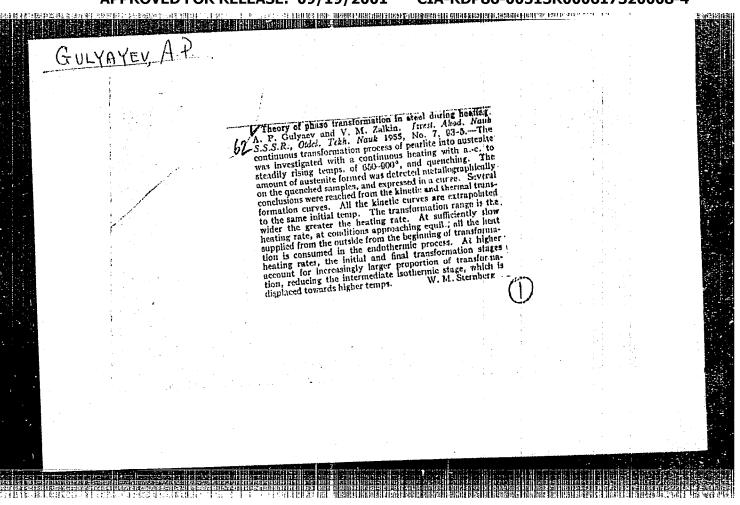












USSR/Metals - Austenite transformation

FD-3046

Card 1/2

Pub. 153 - 15/23

Author

: Gulyayev, A. P.; Akshentseva, A. P.

Title

: Influence of speed of cooling on kinetics of transformation of

austenite to martensite

Periodical

: Zhur. tekh. fiz., 25, February 1955, 299-312

Abstract

: The authors state that study of the influence of cooling rate on transformation of austenite to martensite is important for the technology of steel tempering (knowing this influence one can direct and change the course of the martensite reaction during tempering) and also for the acquisition of new data on the nature of this important phase transformation. They describe experiments conducted mainly on steels of the type Khl2Fl (1.4%C, ll.1%Cr, 0.7%V), this type being chosen because one can obtain in it by chance alone in the tempering temperature austenite of various compositions which has various temperatures of the martensite interval. They conclude that increase in the cooling rate at all temperatures increases the total effect of transformation and in

Card 2/2

FD-3046

Abstract

the end increases the quantity of martensite and that the new facts obtained clarify the leading role of stress in the formation of nuclei of the martensite phase (ibid., 23, 4, 1953). Further, at high temperatures increase of the cooling rate and increase of stresses cause increase in the martensite phase, etc.

Seven references.

Institution

:

Submitted

November 1, 1954

GULYAYEV, H.P.

USSR/Solid State Physics - Phast Transformations in Solids, E-5

Abst Journal: Referat Zhur - Fizika, No 12, 1956, 34682

Author: Alfimov, A. N., Gulyayev, A. P.

Institution: None

Title: Investigation of Martensitic Transformation in Steel

Original Periodical: Zh. Tekhn. Fiziki, 1955, 25, No 4, 680-686

Abstract: An investigation was made of the effect of the dimensions of the grain and of the dimensions of the specimens of the kinetics of the martensitic transformation in steel, and also the position of the temperature of the start of the martensitic transformation as a function of the sensitivity of the investigation methods. The investigation was carried out in a high-sensitivity thermomagnetic installation (Referat Zhur - Fizika, 1956, 22693). The specimens were made of steel containing (in percent) 1.5 C; 0.76 Si; 3.4 Mn. It is shown that when the sensitivity of the installation is reduced from 1 x 10<sup>-5</sup> to 5 x 10<sup>-16</sup>, the temperature at which the first noticeable amounts of martensite were established dropped from -50 to -82°. The martensitic transformation takes place in jumps; the kinetic curves of the transformation, corresponding to the high sensitivity, are in the form

1 of 2

.. 1 \_

USSR/Solid State Physics - Phase Transformations in Solids, E-5

Abst Journal: Referat Zhur - Fizika, No 12, 1956, 34682

Author: Alfimov, A. N., Gulyayev, A. P.

Institution: None

Title: Investigation of Martensitic Transformation in Steel

Original Periodical: Zh. Tekhn. Fiziki, 1955, 25, No 4, 680-686

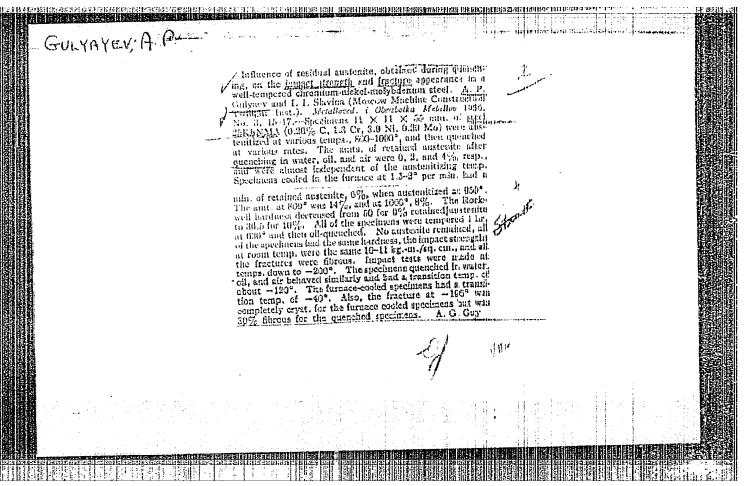
Abstract: of a staircase. The experimentally-determined temperatures of the start of the martensitic transformation have a large dispersion, which increases with increasing sensitivity of measurement. As the specimen diameter is decreased, other conditions being equal, the martensitic point of the steel becomes lower. The same results are obtained by increasing the grain size. Consequently, the more grains there are in a cross section of the specimen, the higher the martensitic point. In monccrystals, the martensitic conversion does not occur even when the specimen is cooled to the temperature of liquid air. The influence of the size of the grain and of the dimensions of the specimen on the martensitic transformation is explained by the authors from the point of view of the decisive role of the second-kind stresses during the process of transformation of austenite into martensite.

2 of 2

- 2 -

GULYAYEV, Aleksandr Paylevich; BOGACHEV, I.N., dektor tekhnicheskikh nauk, prefesser, retsenzent; KUNYAVSKIY, kanditat tekhnicheskikh nauk, detsent, redaktor; PETROV, I.A., redaktor; ZUDAKIN, I.M., tekhnicheskiy redaktor.

[Physical metallurgy] Metallevedenie. Isd. 3-e, perer. Meskva. Ges. isd-ve eber.premyshl., 1956. 343 p. (MIRA 9:6) (Physical metallurgy)



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Category: RUMANIA/Solid State Physics - Phase transformation of solid bodies

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Abs Jour: Ref Zhur - Fizika, No 1, 1957, No 1176

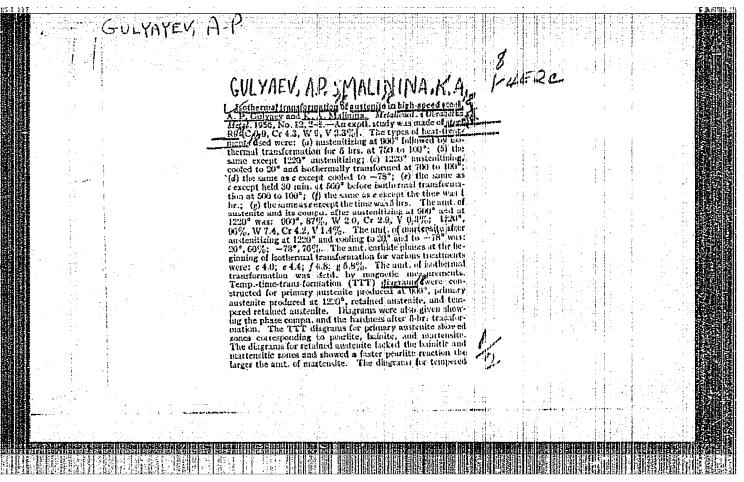
Author : Guliaev, A.P., Zulkin, V.M.

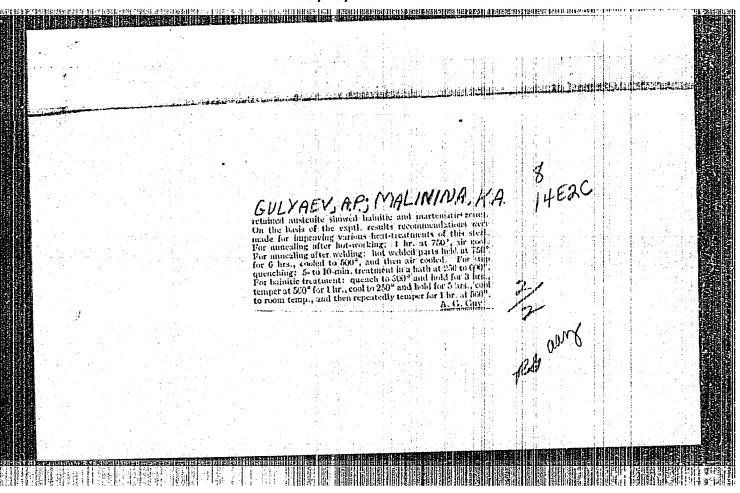
Title : On the Kinetics of the Isothermal Formation of Austenite.

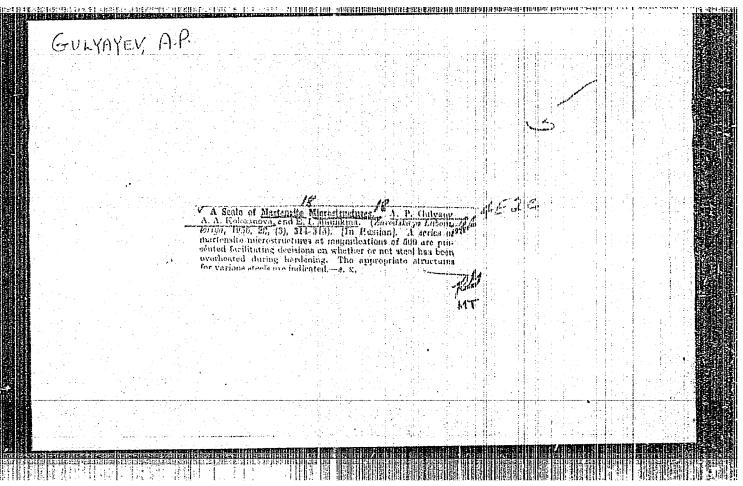
Orig Pub: An. Rom.-Sov. Metalurgie si constr. masini, 1956, 10-No 1, 14-18

Abstract : See Ref. Zhur. Fiz., 1956, 28649

Card : 1/1







137-58-6-13237

Translation from: Referativnyy zhurnal, Metallurgiya, 1958, Nr 6, p 295 (USSR)

AUTHOR: Gulyayev, A.P.

TITLE: Problems of Modern Metallography (Problemy sovremennogo

metallovedeniya)

PERIODICAL: V sb.: Sovrem. napravleniya v obl. tekhnol. mashinostr.

Moscow, Mashgiz, 1957, pp 281-289

ABSTRACT: Bibliographic entry

1. Metallurgy--USSR

Card 1/1

AUTHOR:

Gulyaev A.P., Doctor of Technical Sciences, Professor, and Neverova-Skobeleva, N.P., Engineer. 129-4-4/17

TITLE:

Influence of carbon on the position of the critical range of cold brittleness. (Vliyanie ugleroda na polozhenie kriticheskogo intervala khladnolomkosti.)

PERIODICAL:

"Metallovedenie i Obrabotka Metallov" (Metallurgy and Metal Treatment) 1957, No. 4, pp. 17 - 21 (U.S.S.R.)

ABSTRACT:

The authors considered it advisable to investigate experimentally the influence of the carbon content on the location of the critical temperature range of cold brittleness of heat-treated steel of a given grade with differing carbon contents and also the influence of the carbon content on the location of the critical temperature range of cold brittleness of brittle and of non-brittle steels.

Cr-Ni-Mn-V steel of four different compositions, as specified in Table 1, p. 17, were investigated. The steel was produced in a laboratory 150 kg induction furnace with basic lining of the crucible. From the ingots sheets of 30 x 220 mm were rolled and from these notch impact specimens of 11 x 11 x 55 mm were cut in the longitudinal direction. After normalisation the specimens were hardened and tempered at a high temperature under regimes specified

Card 1/3

Influence of carbon on the position of the critical range of cold brittleness. (Cont.) 129-4-4/17

and a line discrepance of samples of submitted and submitt

in Table 2. To obtain equal hardness the duration of the tempering was varied in accordance with the carbon content. For steels in the tough state (quenched in water after tempering) with 0.19 to 0.24% C a shift is shown in the curves of the temperature dependence of the impact strength towards lower temperatures. A further increase in the C content to 0.55% leads to a shift of these curves towards higher temperatures. On the basis of the change of the quantity of the fibrous component in the fracture of tough specimens with 0.55% C a shift is observed towards increasing temperatures only for the lower branch of the critical cold brittleness range; the first signs of a brittle fracture in this steel is observed at a lower temperature than it is for steel containing 0.42% C. The influence of C on the position of the critical cold brittleness temperature range is most pronounced in tests with brittle specimens (cooled in the furnace from the tempering temperature). In this case an increase in the C content from 0.19 to 0.55% leads to a continuous shift of the critical range of cold brittleness towards lower temperatures. It is concluded that the view that an increase in the carbon content intensifies the tendency to cold brittleness of the steel

Card 2/3

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GULYNYEV, AP

Gulyaev, A. P. and Chernenko, I. V. (TaniiTMASh).

TITLE:

AUTHORS:

Influence of the deformation at low temperatures on the phase transformations and the properties of austenitic 1X18H9T steel. (Vliyanie deformatsii pri nizkikh temperaturakh na fazovye prevrashcheniya i svoystva austenitnoy stali 1X18H9T).

PERIODICAL: "Metallovedenie i Obrabotka Metallov", (Metallurgy and Metal Treatment), 1957, No.5, pp. 2-7 (U.S.S.R.).

ABSTRACT:

The aim of the here described work was to investigate the influence of deformation at sub-freezing temperatures on the transformation of austenite into martensite and the resulting changes in the mechanical properties of the steel. Specimens of steel containing 0.12% C, 0.48% Si, 1.14% Mn, 0.028% P, 0.02% S, 16.9% Cr, 10.5% Ni, 0.61% Ti, were hardened from 1050 C in water (fullest solution of carbides in the austenite) and some of the specimens were subsequently stabilised by annealing at 800°C for 100 hours (intensive separating out of carbides). The austenite to martensite transformation under the influence of plastic deformation was studied at temperatures +100, +80, +20, 0, -20, -74, -95 and -196°C. The deformation was effected by torsion since in this case the cylindrical shape of the specimen is conserved until fracture and there is a uniform deformation along the entire length of the specimen.

Card 1/3card 2/3

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Influence of the deformation at low temperatures on the phase transformations and the properties of austenitic 1X18H9T steel. (Cont.)

A further decrease in temperatures and an increase in the degree of deformation bring about only an insignificant increment in the martensite quantity. In the case of heating of the deformed specimens at 300 to 500°C an inverse  $a_2$  to  $\gamma_2$  transformation takes place; the initial temperature of this transformation depends on the quantity of the martensite forming during the process of deformation. The deformation leads to an increase in the strength and a decrease in the plasticity of the metal; for an equal degree of deformation the increase in strength will be larger if the deformation is accompanied by martensite formation. Austenite forming as a result of the reverse  $a_2$  to  $\gamma_2$  transformation has a higher yield point and relative elongation than austenite of equal strength in which no  $\gamma$  to  $a_2$  transformations took place. Six figures.

**Card** 3/3

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HAR RECORD RESIDENCE AND ADDRESS OF THE PROPERTY OF THE PROPER GULYAYEV, A-1)

AUTHORS: Gulyaev, A.P., Doctor of Technical Sciences Prof. and 129-9-8/14

Zel'bet, B.M. Engineer.

Change in the dimensions of bearing rings during heat TITLE:

treatment. (Izmeneniye razmerov podshipnikovykh kolets

pri termicheskoy obrabotke).

PERIODICAL: "Metallovedeniye i Obrabotka Metallov" (Metallurgy and Metal Treatment), 1957, No.9, pp.28-36 (U.S.S.R.)

The aim of the here described work was to study the relations governing the change in the dimensions of ball bearings during the heat treatment so as to permit taking these dimensional changes adequately into consideration in the machining additions. Ball bearing rings (races) are manufactured by machining from hot or cold rolled tubes, rods or forgings of the steel WX15 followed by hardening in oil from 840-850 C and tempering at 160 C followed by grinding to the final dimensions. The influences were investigated of the geometrical parameters on the change in dimensions of the rings during heat treatment, of technological factors (variations in the heat treatment

Card 1/3 temperatures) on the change in dimensions and the warping of the rings and also the problem of taking into consideration deformations due to the hardening process in establishing the

Change in the dimensions of bearing rings during heat treatment. (Cont.) 129-9-8/14

necessary grinding additions. The here given results relate to rings made of hot rolled annealed tubes, rods and forgings and they are not applicable to cold rolled nonannealed tubes. Fig.2 gives the dependence of the deformation of the ring on the diameter, the height and the thickness; Fig. 3 gives the dependence of the ovality on the diameter and rigidity after heat treatment and after machining; Fig.4 gives the change in ovality during heat treatment as a function of the original ovality; Fig.5 gives the dependence of the deformation and the ovality of rings on the hardening temperature; Fig.6 gives the dependence of the deformation and ovality of rings on the temperature of the hardening medium; Fig. 7 gives the influence of preliminary normalisation annealing on the deformation and the ovality of the rings after hardening and after tempering; Fig.8 gives the influence of preliminary heat treatment; Fig.9 gives the influence of tempering at 150 C; Fig.11 gives the dependence of the changes in ovality on the method of loading (horizontal, vertical); Fig.12 gives the change of the external diameter of the outside bearing rings during heat treatment, whilst in the graph, Fig. 13, the currently

Card 2/3

Change in the dimensions of bearing rings during heat treatment. (Cont.) 129-9-8/14

applied machining additions (in grinding the outside diameter) and the additions proposed by the author on the basis of his experimental results are plotted. The results show that warping (ovality) increases during heat treatment proportionally with increasing diameter and decreasing rigidity (ratio of wall thickness to diameter, S/D) of the ring. Increase of the hardening temperature from 820 to 880 C and of the temperature of the cooling medium from 20 to 80 C and secondary hardening bring about an increase in the ovality. The deformation of the ring depends little on the fluctuation of the temperature during the heating prior to quenching, the temperature of the quenching oil and the preliminary heat treatment. The author proposes a statistical method of determining the deformation of rings and he recommends use of this method for establishing the necessary grinding additions. There are 13 figures and 2 Slavic references.

ASSOCIATION: Moscow Evening Engineering Institute. (Moskovskiy Mashinostroitel'nyy Institut).

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GULYAYEV, AP

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129-1-5/14

Garashchenko, A.P., Candidate of Technical Sciences, AUTHORS:

Gulyaev, A.P., Doctor of Technical Sciences, Professor,

and Luneva, Z.S., Engineer.

Molten Metals and Alloys as a Medium for Heating Steel TITLE:

Components during Heat Treatment (Rasplavlennyye metally

i splavy kak sreda dlya nagreva stal'nykh izdeliy pri

termicheskoy obrabotke)

Metallovedeniye i Obrabotka Metallov, 1958, No.1, PERIODICAL: pp. 21 - 26 (USSR).

ABSTRACT: Local heating is usually effected in lead baths. In view of the danger to the operating personnel and also the scarcity of lead, attempts are being made to substitute this material by others. As a result of the experiments, it was established that aluminium alloys containing 8 to 12% Si can be used for heating steel components to be tempered and that aluminium alloys containing 6 - 10% Si and 5 - 7% Fe can be used for heating steel components to be hardened. As regards speed of heating, the here mentioned alloys are equivalent to molten lead. Measures were developed for protecting the crucibles, the thermocouple casing and the components against erosion and also against increased loss of the alloy when removing Cardl/2 the components. For heating components to 700 - 850 °C, the

129-1-5/14 Molten Metals and Alloys as a Medium for Heating Steel Components during Heat Treatment.

best protection against sticking of aluminium during immersion is coating with dry chalk; the loss in weight in this case will amount to 1 to 3 g/m² and the loss in dimension will amount to 0.02 - 0.045 mm. The protective lining of the crucibles consists of 60% ground chamotte, 35% fire-resistant clay and 2 - 5% borax to which 10 to 15% in weight of the entire mass is added of a mixture of 50% water and 50% liquid glass. The thermocouple casing and laboratory crucibles are protected by a chalk paint consisting of 62% molten chalk, 8% liquid glass and 30% water. There are 3 figures and 4 tables.

ASSOCIATION: All-Union Tool Scientific Research Institute

(Vsesoyuznyy nauchno-issledovatel'skiy Instrumental'

nyy Institut)

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Library of Congress.

Card 2/2

AUTHORS:

Gulyayev, A. P., Zelibet, B. M.

sov/163-58-1-44/53

TITLE:

Diagrams of the State of Volume of Phases in Steels (Diagramma

and the state of the selection of the se

ob"yemnogo sostoyaniya faz v stali)

PERIODICAL:

Nauchnyye doklady vysshey shkoly. Metallurgiya, 1958, Nr 1,

pp 239-243 (USSR)

ABSTRACT:

In the present paper the authors experimentally constructed the diagrams of the state of volume of phases with the determination

of the martensite points as well as the specific volume of austenite and martensite at different temperatures on one and

the same material.

The steel Shin [with 1% C, 1,4% Cr] was used as initial material. The samples of steel ShKh15 were heated to different temperatures

within the temperature range from 800 to 960° and then were

rapidly tempered in salt water.

The phase state of the steel ShKn!5 after tempering and as dependent on different temperatures was investigated. The results obtained supply a complete picture of the phase composition in tempered steel, the parameter magnitude of the lattices and

partly also of the qualitative ratio prevailing.

Card 1/3

The specific volume of cementite was determined at room tempera-

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507/163-58-1-44/53

Diagrams of the State of Volume of Phases in Steels

ture in relation to the carbon content in solid solutions. The coefficient of linear expansion  $\alpha$  of martensite and austenite within the range from 200 to 220°C was determined in relation to the carbon content. It was shown that the  $\alpha$  of martensite and austenite practically does not depend on the carbon content in these phases. The martensite transformation in steel begins with the reaching of a certain difference between the specific volume of austenite and martensite, viz., at 0,0044  $\pm$  0,0002

 ${\rm cm}^3/{\rm g}$ , and at a certain difference in the interatomic distances of austenite and martensite of 0,80 Å. An empirical dependence of the coefficient of expansion in volume of austenite and martensite on the temperature was found, which can be calculated by the following formula:

 $\beta_{t'_{m}} = 30,36.10^{-6} + 0,049.10^{-6}t; \beta_{t_{n}} = 62,31.10^{-6} + 0,02,.10^{-6}t$ 

The constructed diagram of the state of volume of the phase of steel ShKh: 5 may be used in practice in the investigation of the rules governing the changes in volume in thermal treatment. There are 2 figures, 5 tables, and 7 references, 6 of which are Soviet.

Card 2/3

507/163-58-1-44/03

Diagrams of the State of Volume of Phases in Steels

ASSOCIATION: Moskovskiy vecherniy mashinostroitel'nyy institut (Moscow

Evening School for Machine Building)

SUBMITTED: October 1, 1957

Card 3/3

GULYAYEV, A.P.

129-2-10/11

Bogachev, I.N., Grozin, B.D. and Gulyayev, A.P., AUTHORS:

Doctors of Technical Sciences, Professors:

Scientific and Technical Conference on Heat Treatment of TITLE:

Metals Held in Warsaw (Nauchno-tekhnicheskaya konferentsiya

po termicheskoy obrabotke metallov v Varshave)

Metallovedeniye i Obrabotka Metallov, 1958, No.2, PERIODICAL: pp. 52 - 55 (USSR).

The Polish Society of Mechanical Engineers convened a conference for October 7 - 8, 1957 on heat treatment of metals, ABSTRACT: in which about 1 500 people participated from Poland and there were also delegates present from the Soviet Union and East

S. Przegalinski read a paper on "The Principles of Selection of Alloy Structural Steel"; this author believes that excessive importance is attached to ductility properties and considers that important criteria in selecting structural steels are the structure in the hardened state and also the hardness distribution along the cross-section. The authors of this report do not fully agree with some of the opinions expressed in this Polish paper.

Prof. A.P. Gulyayev read the paper "Isothermal Transformation Cardl/5 of Austenite in High-speed Steel" which was originally published

129-2-10/11

Scientific and Technical Conference on Heat Treatment of Metals Held in Warsaw.

in No.12, 1956, of this journal. At the sectional meeting, A. Moszczynski and G. Matyj read the paper "Chemical-heat Treatment Inside Liquid Media Using Induction Heating" which attracted great attention; they described a simple method consisting of submersion of the inductor and a specimen into a liquid which contained the elements necessary for saturating the steel. After heating of the specimens by the current, the liquid surrounding the specimen starts to evaporate and forms a vapour shell; the vapour decomposes, forming elements in the atomary state which are absorbed by the surface of the steel and diffused into the steel. The inductor voltage must be so chosen that thermal equilibrium is reached and the desired isothermal process is obtained. Some results relating to case-hardening, nitriding and cyaniding are mentioned in the paper.

L. Kalinowski read the paper "Carbon Balance During Gas

L. Kalinowski read the paper "Carbon Balance During Gas Cementation"; according to his calculations, only 2 - 4% of the carbon which streams into the furnace is absorbed by the metal, 36-50% is removed with the gases and 42 - 60% settles

card2/5 as soot.

129-2-10/11

Scientific and Technical Conference on Heat Treatment of Metals Held in Warsaw.

W. Witek read the paper "Gas Cementation by means of Liquid Hydrocarbons".

S. Kowal read the paper "Cementation of Steel by means of watural Gas".

Two papers were devoted to heat treatment of case-hardened steels, namely:

J. Wyszkowski read the paper "Heat Treatment of Case-hardened Steels Taking Into Consideration the Grain Size", showing that the heat treatment after case-hardening should be determined by taking into consideration the grain size.

Z. Leszczynski, J. Lemnicka and J. Lemnicki read the paper "Chemico-thermal Treatment of Gears".

E. Zmichorski read the paper "Heat Treatment of Long Tools Made of High-alloy Steels", describing an original design of an electrode-salt bath for heating prior to hardening of reamers made of high-speed steel, a sketch of which is shown in Fig. 4, p. 54.

G. Prignic read the paper "Heat Treatment of Accurate Metering Gauges".

S. Jablonski read the paper "Possibility of Applying Controlled Card3/5 Atmospheres for Heat Treatment in the Polish Industry".

129-2-10/11

Scientific and Technical Conference on Heat Treatment of Metals Held in Warsaw.

P. Kosieradski read the paper "Cyaniding Bath".

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B. Korwadynski, S. Jablonski and Prof. B. Sachir and J. Madian read the paper "Equipment of Heat Treatment Shops and Heat Treatment Furnaces".

S. Orzechowski read the paper "Application of the Method of Mikved during Control Tests of Steel Components".

M. Kozlowski read the paper "Comparison of the Properties of Components which were Heat-treated by Surface-hardening and by Chemico-thermal Methods"

Dotsent E. Zmachorski read the paper "Influence of Magneto-striction Oscillations on the Changes of the Structure and the Properties of Hardened Steels"; he investigated high-carbon steels with 1.13 - 1.60% carbon, containing 1.3-2.8% chromium and no chromium.

Prof. F. Sztaub read the paper "Microhardness and Structural Components of Induction-hardened, High-speed Steels", showing that the microhardness of the carbide phase changes as a function of the heat treatment regime (Fig. 5).

Ya. Tymowski read the paper "Comparison of the Properties of Structural Steels Improved by Heat Treatment and of Isothermally-Card4/5 hardened Structural Steels", in which he analyses literary data.

Scientific and Technical Conference on Heat Treatment of Metals Held in Warsaw.

He showed that alloy steels containing carbide-forming elements have higher creep values at 350 - 550 °C after isothermal heat treatment to obtain acicular troostite.

There are five figures.

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129-58-7-1/17

AUTHORS: Gulyayev, A. P., Doctor of Technical Sciences, Professor,

Rustem, S.L. Candidate of Technical Sciences and Orekhov, G. N. and Alekseyeva, G.P., Engineers

Investigation of New Die Making Steels for Hot Stamping TITLE:

of High Temperature Alloys (Issledovaniye novykh

shtampovykh staley dlya goryachey shtampovki zharoprochnykh

splavov)

PERIODICAL: Metallovedeniye i Obrabotka Metallov, 1958, Nr 7,

pp 2-10 + 2 plates (USSR)

ABSTRACT: This study has been awarded a prize at the imeni D.K. Chernov

NTO Mashprom competition for the best research work carried out in 1955-1957. For hot stamping the Soviet steels 5KhNM and 5 KhGM were used in the past and were subsequently substituted by various steels not containing molybdenum, which is a scarce material in the Soviet Union. In the introduction the authors summarise the effects of the individual elements thus: 1 tungsten ensures red hardness up to 620°C and improves the wear resistance. A tungsten content exceeding 10% will not bring any further improvement in the properties. On the other hand, it affects

adversely the resistance of the materials to temperature Card 1/5

Carling that the first batter and exaltabilities many adalesses so in it has not been been a contract to the

Investigation of New Die Making Steels for Hot Stamping of High Temperature Alloys

changes, it brings about an increase in the quantity of ferrite at the hardening temperature and a tendency to form grinding cracks. 2. Molybdenum is twice as effective as tungsten. For an equal hardness, molybdenum stee! will have better physical properties than tungsten steel. Molybdenum improves the hardenability, increases the resistance to scoring, improves the hardness. it reduces the hardening temperature range, it causes surface decarburisation and makes the steel susceptible to grain growth, 3. Chromium reduces the tendency of the steel to oxidise, improves the hardenability and ensures red hardness up to 425°C. However, longer heating is necessary for dissolving the carbides. 4. Vanadium reduces the grain size. 5. Silicon influences the character of the scale forming in air; instead of a dense film an easily removeable powdery oxide is obtained. Furthermore, it increases the wear resistance. Of great importance is carbon which increases the strength, the wear resistance and the hardenability. However, un increased carbon content brings about increased brittleness and scoring

Card 2/5

129-58-7-1/17 Investigation of New Die Making Steels for Hot Stamping of High Temperature Alloys

Die-making steel contains 0.25 to 0.60% C. Fifteen new grades of die-making steels were developed and investigated. For comparing the properties of these steels the Soviet steel 3Kh2V8 has also been investigated and the respective values are used as reference values. The chemical compositions of the investigated steels are entered in Table 1, p.3: A technique has been developed for testing die-making steels. The obtained results are described in great detail; they are also entered in tables and plotted in graphs. In Fig.1, p,4 the influence of the hardening temperature on the hardness of some experimental steels is graphed. Figs. 2-5 (plate) show the micro-structure of some of the investigated steels after various heat treatment regimes. In Fig.6 the dependence is graphed of the hardness of some of the experimental steels on the temperature temperature. Fig. 7 shows the hardenability of the experimental steels, Fig.8 shows the dependence of the strength of the experimental steels on the test temperature. Fig.9 shows the dependence of the yield point of the investigated

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Investigation of New Die Making Steels for Hot Stamping of High Temperature Alloys

steels on the temperature. Fig. 10 shows the dependence of the relative elongation of the investigated steels on the temperature. Fig.11 shows the dependence of the relative contraction of these steels on the temperature, Fig. 12 shows the dependence of the impact strength of the investigated steels on the temperature, Fig. 13 shows the hot hardness of the experimental steels, Fig. 14 indicates the resistance to temperature changes of the individual experimental steels. Table 2 gives the hardness of the investigated steels after hardening and tempering from various temperatures. Table 3 gives the hardness of the experimental steels after heating to the hardening temperature and cooling under various conditions. The main data on the mechanical properties and chemical compositions of the experimental steels are summarised in Table 5. The mc important properties of these steels from the point of view of manufacturing dies were determined. Furthermore, four steels for manufacturing dies to be used for stamping high tempera-Card 4/5 ture steels are proposed, the chemical analyses of which

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Investigation of New Die Making Steels for Hot Stamping of High Temperature Alloys

are entered in Table 6, p.10. The authors advocate testing these steels under shop conditions. There are 14 figures, 6 tables and 7 references, 1 of which is Soviet, 1 German and 5 English.

ASSOCIATION: Moskovskiy vecherniy mashinostroitel'nyy institut (Moscow Evening Mechanical Engineering Institute)

Card 5/5

SOV/129-58-11-7/13

AUTHORS: Gulyayev, A. P., Doctor of Technical Sciences, Professor,

Luneva, Z.S., Korolev, G. G. and Samoylov, V.V., Engineers

TITLE: Heat Treatment of Tools Made of High Speed Steel. in a

Steam Atmosphere (Termicheskaya obrabotka instrumentov

iz bystrorezhushchey stali v atmosfere para)

PERIODICAL: Metallovedeniye i Obrabotka Metallov, 1958, Nr 11,

pp 39-44 (USSR)

ABSTRACT: According to data of various authors, the service life of tools made of high speed steel is increased by 50 to

100% if they are heat treated in steam after being

finish — machined and ground. In order to establish the effectiveness of such heat treatment, the authors carried out experiments with specimens and drills made of the steels

R9 and R18 which, prior to treatment with steam, were hardened, tempered, sharpened and ground. The treatment with steam was effected in a hermetically closed electric furnace, a sketch of which is shown in Fig.2, in which

the temperature was maintained automatically within  $\pm$  5°C. The steam pressure was maintained at 0.1-0.2 atm. To

prevent the formation of Fe<sub>2</sub>O<sub>2</sub> on the machined surfaces, Card 1/4 the steam has to be introduced in the super-heated state.

### CIA-RDP86-00513R000617320008-4 "APPROVED FOR RELEASE: 09/19/2001

SOV/129-58-11-7/13

Heat Treatment of Tools Made of High Speed Steel in a Steam Atmosphere

Only then will a film form consisting of magnetic iron oxides which is the reason for the high corrosion stability and the good appearance of the thus treated tools. treatment procedure is graphed in Fig.1. Prior to introducing steam, the temperature is raised to 350-370°C and the tools are held at that temperature for 20 to 30 mins. Then, steam is introduced and the temperature is maintained at the same level for a further 30 mins. Following that, the temperature is raised to 540-550°C, maintained constant at that temperature for 30-60 mins and, finally, cooled in air and quenched in oil. The graph, Fig.3, shows the measured thickness of the oxide film on the steel R9 treated in a steam atmosphere at various temperatures with a holding time of 30 mins; in Fig. 4 the thickness is graphed of the oxide film on the steel R9 treated in a steam atmosphere at 550°C as a function of the holding time. It was found that the oxide film produced by steaming is considerably denser than that produced by Card 2/4 alkali oxidation. The corrosion stability and the

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SOV/129-58-11-7/13

Heat Treatment of Tools Made of High Speed Steel in a Steam Atmosphere

resistance to seizure was also measured as well as the service life. On the basis of the obtained results a heat treatment regime in a steam atmosphere was developed for tools made of high speed steels. steam treatment is recommended as an additional treatment of sharpened and ground tools for the purpose of improving their resistance to corrosion and their Steam is also recommended as an cutting performance. atmosphere in the furnace during tempering for the purpose of preventing erosion of the tool surface; in this case no inter-cycle chemical treatment is necessary. After steam treatment at 500 to 600°C a dense film of the magnetic oxide Fe<sub>2</sub>O<sub>4</sub> forms, the the kness of which is 1-4µ. The presence on the surface of such a film leads to an increase of the adhesion temperature (build up of machined metal onto the high speed steel) by 100-150°C and this explains the improved cutting properties; furthermore, steam treatment does not bring about a drop in the surface quality during heating in saltpetre and in air, which is also important from the

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Heat Treatment of Tools Made of High Speed Steel in a Steam Atmosphere

point of view of improving the service life of the tool. Steam treatment is at present applied by numerous Works and should be used on a larger scale. There are 9 figures, 1 table and 4 references, 3 of which are English, 1 French.

ASSOCIATIONS: VNII, Zavod "Frezer" (Frezer Works) and ZIL

- 1. Tools--Heat treatment 2. Tool steel--Properties
- 3. Steam--Metallurgical effects

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SOV/126-6-5-13/43

TO BON TO A MUNICIPALISM SANDER MANAGEMENT OF PRESENTATION OF THE PROPERTY OF

AUTHORS: Gulyayev, A.P., and Zel'bet, B.M.

Diagram of the Phase Volumes of Steel ShKhl5 TITLE:

(Diagramma ob yemnogo sostoyamiya faz v stali ShKhl5)

PERIODICAL: Fizika Metallov i Metallovedeniya, 1958, Vol 6,

Nr 5, pp 843 - 848 (USSE)

Yur'yev's "phase volume diagram" (Ref 1) shows the ABSTRACT:

change in specific volume of individual phases in Fe-C

alloys (austenite, martensite,  $\alpha$  and  $\gamma$ -iron and cementite) with change in temperature. From a consideration of this diagram he concluded that, irrespective of carbon content, the transformation of austenite into martensite commences at a definite specific volume

of austenite, which for carton steel is

 $0.12590 \pm 0.00010$  cm<sup>2</sup>/g. In general, this means that austenite transforms at the moment when the iron atoms in the Y-lattice, due to contraction on cooling, reach a definite limiting distance. This agrees with earlier assumptions by Sądovskiy and Yakutovich (Ref 2), who specified 3.607 A as the critical lattice parameter of

austenite at which martensite begins to form.

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Diagram of the Phase Volumes of Steel ShKhl5

other authors (Refs 3, 4 and 5) disagree with this view. Taking Kurdyumov's mechanism of martensite transformation (Ref 6) as the basis, Arkharov proposed certain crystal geometry relationships which must be satisfied for the initiation of martensite formation. The martensitic  $\gamma \rightarrow \alpha$  transformation, according to Kurdyumov, consists in a regular shift of atoms in the  $\gamma$ -iron lattice relative to each other by distances less than inter-atomic. Arkharov developed this theory further and stipulated that the distance between the closest atoms along the [101] and [111] directions must attain a certain critical value for the  $\gamma \rightarrow \alpha$  change to take place. Figure 1 shows the relationship between the austenitic lattice parameter and temperature but from this diagram there is no evidence to support the above theories, which are based only on literature data. Hence, the authors of this paper decided to construct experimentally a phase volume diagram and determine the  $M_S$  point and the specific volumes of

austenite and martensite at various temperatures in one material. The steel ShKhl5 (1.0% C, 1.4% Cr) was chosen

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Diagram of the Phase volumes of Steel ShKhl5

for this purpose. For the construction of the diagram the specific volumes of the phases ( $\gamma$ ,  $\alpha$  and cementite) at various carbon contents (for the  $\gamma$  and  $\alpha$ -phases) and various temperatures must be known. This information was obtained by quenching the steel specimens from temperatures in the range 800 to 960 °C in brine. As quenched, the steel structure consists of three phases - martensite, austenite and carbides. The quantitative relationship and composition of the first two phases change with querohing temperature. The results are given in Table 1. If the composition and the lattice parameters of the phases are known, their specific volumes can be calculated (Ref 1), the latter, at room temperature, are given in Table 2. the coefficient of linear expansion for each phase is determined, the diagram can be constructed. These coefficients were derived experimentally and are given in Table 3. The diagram for the phase volumes of the steel ShKhl5 is shown in Figure 2, the position of the M point in

relation to carbon content and quenching temperature is given in Table 4 and the specific volumes of lattice

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Diagram of the Phase Volumes of Steel ShKhl5

parameters of austenite and martensite at the temperature at which the martensitic transformation commences, in Table 5. From a consideration of the above results the authors arrived at the following conclusions: martensitic transformation of any composition of a given steel does not commence on attaining a constant specific volume, but when a difference between the specific volumes of austenite

and the antime they distributed contributions of suffice resembles on a measure of the contribution of the

and martensite of  $0.0044 \pm 0.0002$  cm<sup>2</sup>/g and between the interatomic distances along the combined directions of austenite [101] and martensite [111] of  $0.080 \pm 0.003$  A has been attained. An experimental dependence of the coefficients of volume expansion of austenite and martensite on temperature is expressed by the formulae:

$$\beta_{t_{M}} = 30.36 \times 10^{-6} + 0.049 \times 10^{-6}$$
 and  $\beta_{t_{A}} = 62.31 \times 10^{-6} + 0.027 \times 10^{-6}$ .

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The phase volume diagram for the steel ShKhl5 may find practical application for the study of volume changes due to heat treatment.

507/126-6-5-13/43

Diagram of the Phase Volumes of Steel ShKhl5

There are 2 figures, 5 tables and 8 references, 7 of which are Soviet and 1 German.

Moskovskiy vecherniy mashinostroitel'nyy institut (Moscow Evening Institute for Machine Building) ASSOCIATION:

SUBMITTED: February 4, 1957

Card 5/5

SOV/126-6-5-16/43

Arskiy, V.N., and Gulyayev, A.P. AUTHORS:

Kinetics of the Formation of Deformation Martensite TITLE:

(Kinetika obrazovaniya martensita deformatsii)

Fizika Metallov i Metallovedeniye, 1958, Vol 6, PERIODICAL:

Nr 5, pp 866 - 873 (USSR)

A distinction is made between deformation martensite ABSTRACT:

and quench martensite. The aim of the present work was to investigate the kinetics of the formation of deformation martensite, as well as to compare the process of deformation martensite-formation with that of martensite formation on The investigation was carried out using nickel steels made in the laboratory, the composition of which is given in Table 1. Besides the elements indicated, the ingots contained approximately 0.25% Si, 0.20% Mr,

0.02% P and 0.02% S. For the study of martensite formation during deformation, the ingots of the investigated steels were forged into rods of 12 mm dia from which tensile test specimens and specimens for the study of the martensitic transformation during cooling were made. Specimens were quenched from 1 220 °C, heating being carried out in

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SOV/126-6-5-16/43 Kinetics of the Formation of Deformation Martensite

For the study of the formation of deformation martensite, the quenched specimens were pulled in the tensile testing machine IM-12-A. As the specimen was pulled in tension, the quantity of martensite forming was measured at the same time as measurements were carried out of deformation forces by means of a specially constructed magnetometer. The principle of the layout of the apparatus is shown in Figure 1, where 1 - primary-, 2 - measuring-, 3 - compensating coils, 4 - the specimen, 6 - the rectifier. In Figure 2, extension curves and martensite curves for all the investigated steels are shown. The normal martensite curves for the same steels, i.e. curves for martensite obtained on cooling, are shown in Figure 4. Figure 5 shows martensite curves for steel 95019 as obtained by deformation at various deformation speeds. Martensite curves for conditions under which martensite forms under constant loading ("isobar martensite curves") are shown in Figure 6. The results obtained from the curves of Figures 2 and 4 are given in Table 2. It is shown that externally applied forces cause martensite transformation which can be represented in the form of martensite

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Kinetics of the Formation of Deformation Martensite

curves (see Figures 2 and 5). The lowering in temperature for development of the martensitic transformation is analogous to increase of the externally applied force. The influence of the rate of loading and the magnitude of the constant load for the formation of deformation martensite are shown, the latter being analogous to the influence of the cooling rate and to the temperature of isothermal soaking at which quench martensite forms. The influence of the position of the  $\rm\,M_{_{\rm S}}$  point and other indicators of the development of the transformation of austenite into martensite during deformation is shown. When the deformation is carried out below the Mg point, i.e. when the specimen already contains a certain quantity of quench martensite, external forces do not lead to a full transformation of austenite into martensite owing to the low plasticity of the specimen. If the load is applied at the temperature, the stresses lead eventually to a complete austenite-martensite reaction. This is due to the austenite above the  $M_s$  point being less prone to becoming

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SOV/126-6-5-16/43 ...inetics of the Formation of Deformation Martensite

transformed into martensite under the influence of deformation and the higher the deformation temperature in relation to the  $\rm M_{\rm S}$  point the lower the tendency for deformation martensite to form. Thus, the maximum quantity of deformation martensite forms when the deformation temperature coincides with the  $\rm M_{\rm S}$  point. Identical influences of lowering the temperature (below the  $\rm M_{\rm S}$  point) and of increase in force (above  $\sigma_{\rm M}$ ) show that a lowering in temperature causes stresses which lead to martensite formation. Approximate calculations show that in the investigated steels an increase in stress above the yield point by 2 kg/mm² causes the formation of approximately 1% martensite. The same quantity of martensite forms when the temperature is lowered by 1°C. It appears that a lowering of temperature by 1°C under the experimental conditions described causes a stress of

Card4/5 approximately 2 kg/mm<sup>2</sup>.

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Kinetics of the Formation of Deformation Martensite

There are 6 figures, 2 tables and 5 references, 4 of which are Soviet and 1 German.

Tsentral'nyy nauchno-issledovatel'skiy institut ASSOCIATION:

tekhnologii i mashinostroyeniya

(Central Scientific Research Institute of Technology and Construction of Machines)

SUBMITTED: January 31, 1957

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CIA-RDP86-00513R000617320008-4" **APPROVED FOR RELEASE: 09/19/2001** 

SOV/126-6-5-30/43

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Gulyayev, A.P., and Zelenova, V.D. AUTHORS:

X-ray Investigation of the Transformation of Martensite TITLE:

on Tempering a Powder and a Solid Specimen (Rentgenegraficheskoye issledovaniye prevrashcheniya martensita

pri otpuske v poroshke i v sploshnom obraztse)

Fizika Metallov i Metallovedeniye, 1958, Vol 6, Nr 5, PERIODICAL:

pp 936 - 937 (USSR)

In the papers (Refs 1 and 2) a method for the separation ABSTRACT:

of isolated martensite from quenched steel by anodic solution has been described. This method was applied in the present work, the aim of which was to compare the process of martensite decomposition on tempering in a solid specimen with that of isolated crystals of marten-From X-ray photographs it is evident that in isolated martensite stresses of the second order are considerably less, which confirms earlier conclusions (Refs 1, 3). In order to study the characteristics of decomposition of isolated martensite during tempering, simultaneous heating of the specimen and of the powder was carried out at various temperatures, followed by

soaking for five minutes and in the case of other specimens Cardl/3

CIA-RDP86-00513R000617320008-4"

APPROVED FOR RELEASE: 09/19/2001

SOV/126-6-5-30/43

X-ray Investigation of the Transformation of Martensite on Tempering a Powder and a Solid Specimen

for various soaking times at 100 °C. The carbon concentration in the solid solution was worked out by the formula:

 $C = \frac{c/a - 1}{0.0467}$ 

where C is the weight percentage of carbon in martensite, c/a is the degree of tetragonality of the martensite lattice.

The results of these measurements are shown in Figures 1 and 2. In the residual austenite of the quenched steel compressive stresses arise which must be balanced by tensile stresses in the martensite; these are evidently removed on isolating crystals of martensite. The lattice parameter of the martensite in quenched steel in the solid specimen is 2.983 Å and in the powder of the same specimen 2.969 Å. Hence, tensile stresses enlarge the lattice of

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SOV/126-6-5-30/43 X-ray Investigation of the Transformation of Martensite on Tempering a Powder and a Solid Specimen

martensite which causes a greater percentage of carbon to be retained in solution. There are 2 figures, and 4 references, 3 of which are Soviet and 1 German.

ASSOCIATION:

Gosudarstvennyy nauchno-issledovatel'skiy avto-

mobil'nyy i avtomotornyy institut

(State Scientific Research Automobile and

Automobile Engines Institute)

SUBMITTED:

May 15, 1957

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AUTHORS:

Gulyayev, A.P., and Zelenova, V.D.

TITLE:

Investigation of Martensitic Transformation in Austenitic Powder (Issledovaniye martensitnogo prevrashcheniya v

austenitnom poroshke)

PERIODICAL:

Fizika Metallov i Metallovedeniye, 1958, Vol 6,

Nr 5, pp 945 - 946 (USSR)

ABSTRACT:

Abruzov, N.P. (Refs 1 and 2) showed that the method of electrolytic dissolution of steels is applicable not only

for separating out the carbide phase but also for

separating out martensite from hardened steel. If steel with austenite as the basic phase component is subjected to electrolytic dissolution, provided certain electrolysis regimes are maintained, a residue can be obtained consisting of isolated γ-phase crystallites. The austenite powder was obtained by anodic dissolution of austenitic steel according to a regime used by N.M. Popova (Ref 3) for separating out the carbide phase, except that instead of cooling the electrolyte (which is recommended for a carbide analysis) it was heated to 30 - 50°C. Even at temperatures below +5°C, cooling of the electrolyte leads to a reduction in the content of the austenitic phase in

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